

APPENDIX G TO PART 121—DOPPLER RADAR AND INERTIAL NAVIGATION SYSTEM (INS): REQUEST FOR EVALUATION; EQUIPMENT AND EQUIPMENT INSTALLATION; TRAINING PROGRAM; EQUIPMENT ACCURACY AND RELIABILITY; EVALUATION PROGRAM

1. *Application authority.* (a) An applicant for authority to use a Doppler Radar or Inertial Navigation System must submit a request for evaluation of the system to the Flight Standards District Office or International Field Office charged with the overall inspection of its operations 30 days prior to the start of evaluation flights.

(b) The application must contain:

(1) A summary of experience with the system showing to the satisfaction of the Administrator a history of the accuracy and reliability of the system proposed to be used.

(2) A training program curriculum for initial approval under § 121.405.

(3) A maintenance program for compliance with subpart L of this part.

(4) A description of equipment installation.

(5) Proposed revisions to the Operations Manual outlining all normal and emergency procedures relative to use of the proposed system, including detailed methods for continuing the navigational function with partial or complete equipment failure, and methods for determining the most accurate system when an unusually large divergence between systems occurs. For the purpose of this appendix, a large divergence is a divergence that results in a track that falls beyond clearance limits.

(6) Any proposed revisions to the minimum equipment list with adequate justification therefor.

(7) A list of operations to be conducted using the system, containing an analysis of each with respect to length, magnetic compass reliability, availability of en route aids, and adequacy of gateway and terminal radio facilities to support the system. For the purpose of this appendix, a gateway is a specific navigational fix where use of long range navigation commences or terminates.

2. *Equipment and equipment installation—Inertial Navigation Systems (INS) or Doppler Radar System.* (a) Inertial Navigation and Doppler Radar Systems must be installed in accordance with applicable airworthiness requirements.

(b) Cockpit arrangement must be visible and useable by either pilot seated at his duty station.

(c) The equipment must provide, by visual, mechanical, or electrical output signals, indications of the invalidity of output data upon the occurrence of probable failures or malfunctions within the system.

(d) A probable failure or malfunction within the system must not result in loss of the aircraft's required navigation capability.

(e) The alignment, updating, and navigation computer functions of the system must not be invalidated by normal aircraft power interruptions and transients.

(f) The system must not be the source of cause of objectionable radio frequency interference, and must not be adversely affected by radio frequency interference from other aircraft systems.

(g) The FAA-approved airplane flight manual, or supplement thereto, must include pertinent material as required to define the normal and emergency operating procedures and applicable operating limitations associated with INS and Doppler performance (such as maximum latitude at which ground alignment capability is provided, or deviations between systems).

3. *Equipment and equipment installation—Inertial Navigation Systems (INS).* (a) If an applicant elects to use an Inertial Navigation System it must be at least a dual system (including navigational computers and reference units). At least two systems must be operational at takeoff. The dual system may consist of either two INS units, or one INS unit and one Doppler Radar unit.

(b) Each Inertial Navigation System must incorporate the following:

(1) Valid ground alignment capability at all latitudes appropriate for intended use of the installation.

(2) A display of alignment status or a ready to navigate light showing completed alignment to the flight crew.

(3) The present position of the airplane in suitable coordinates.

(4) Information relative to destinations or waypoint positions:

(i) The information needed to gain and maintain a desired track and to determine deviations from the desired track.

(ii) The information needed to determine distance and time to go to the next waypoint or destination.

(c) For INS installations that do not have memory or other inflight alignment means, a separate electrical power source (independent of the main propulsion system) must be provided which can supply, for at least 5 minutes, enough power (as shown by analysis or as demonstrated in the airplane) to maintain the INS in such condition that its full capability is restored upon the reactivation of the normal electrical supply.

(d) The equipment must provide such visual, mechanical, or electrical output signals as may be required to permit the flight crew to detect probable failures or malfunctions in the system.

4. *Equipment and equipment installation—Doppler Radar Systems.* (a) If an applicant elects to use a Doppler Radar System it must be at least a dual system (including

dual antennas or a combined antenna designed for multiple operation), except that:

(1) A single operating transmitter with a standby capable of operation may be used in lieu of two operating transmitters.

(2) Single heading source information to all installations may be utilized, provided a compass comparator system is installed and operational procedures call for frequent cross-checks of all compass heading indicators by crewmembers.

The dual system may consist of either two Doppler Radar units or one Doppler Radar unit and one INS unit.

(b) At least two systems must be operational at takeoff.

(c) As determined by the Administrator and specified in the certificate holder's operations specifications, other navigational aids may be required to update the Doppler Radar for a particular operation. These may include Loran, Consol, DME, VOR, ADF, ground-based radar, and airborne weather radar. When these aids are required, the cockpit arrangement must be such that all controls are accessible to each pilot seated at his duty station.

5. *Training programs.* The initial training program for Doppler Radar and Inertial Navigation Systems must include the following:

(a) Duties and responsibilities of flight crewmembers, dispatchers, and maintenance personnel.

(b) For pilots, instruction in the following:

(1) Theory and procedures, limitations, detection of malfunctions, preflight and inflight testing, and cross-checking methods.

(2) The use of computers, an explanation of all systems, compass limitations at high latitudes, a review of navigation, flight planning, and applicable meteorology.

(3) The methods for updating by means of reliable fixes.

(4) The actual plotting of fixes.

(c) Abnormal and emergency procedures.

6. *Equipment accuracy and reliability.* (a) Each Inertial Navigation System must meet the following accuracy requirements, as appropriate:

(1) For flights up to 10 hours' duration, no greater than 2 nautical miles per hour of circular error on 95 percent of system flights completed is permitted.

(2) For flights over 10 hours' duration, a tolerance of ± 20 miles cross-track and ± 25 miles along-track on 95 percent of system flights completed is permitted.

(b) Compass heading information to the Doppler Radar must be maintained to an accuracy of $\pm 1^\circ$ and total system deviations must not exceed 2° . When free gyro techniques are used, procedures shall be utilized to ensure that an equivalent level of heading accuracy and total system deviation is attained.

(c) Each Doppler Radar System must meet accuracy requirements of ± 20 miles cross-track and ± 25 miles along-track for 95 percent of the system flights completed. Updating is permitted.

A system that does not meet the requirements of this section will be considered a failed system.

7. *Evaluation program.* (a) Approval by evaluation must be requested as a part of the application for operational approval of a Doppler Radar or Inertial Navigation System.

(b) The applicant must provide sufficient flights which show to the satisfaction of the Administrator the applicant's ability to use cockpit navigation in his operation.

(c) The Administrator bases his evaluation on the following:

(1) Adequacy of operational procedures.

(2) Operational accuracy and reliability of equipment and feasibility of the system with regard to proposed operations.

(3) Availability of terminal, gateway, area, and en route ground-based aids, if required, to support the self-contained system.

(4) Acceptability of cockpit workload.

(5) Adequacy of flight crew qualifications.

(6) Adequacy of maintenance training and availability of spare parts.

After successful completion of evaluation demonstrations, FAA approval is indicated by issuance of amended operations specifications and en route flight procedures defining the new operation. Approval is limited to those operations for which the adequacy of the equipment and the feasibility of cockpit navigation has been satisfactorily demonstrated.

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APPENDIX H TO PART 121—ADVANCED SIMULATION

This appendix provides guidelines and a means for achieving flightcrew training in advanced airplane simulators. The requirements in this appendix are in addition to the simulator approval requirements in §121.407. Each simulator used under this appendix must be approved as a Level B, C, or D simulator, as appropriate.

ADVANCED SIMULATION TRAINING PROGRAM

For an operator to conduct Level C or D training under this appendix all required simulator instruction and checks must be conducted under an advanced simulation training program approved by the Administrator for the operator. This program must also ensure that all instructors and check airmen used in appendix H training and checking are highly qualified to provide the training required in the training program.